Fixing 2.4GHz Radio Receiver Antenna

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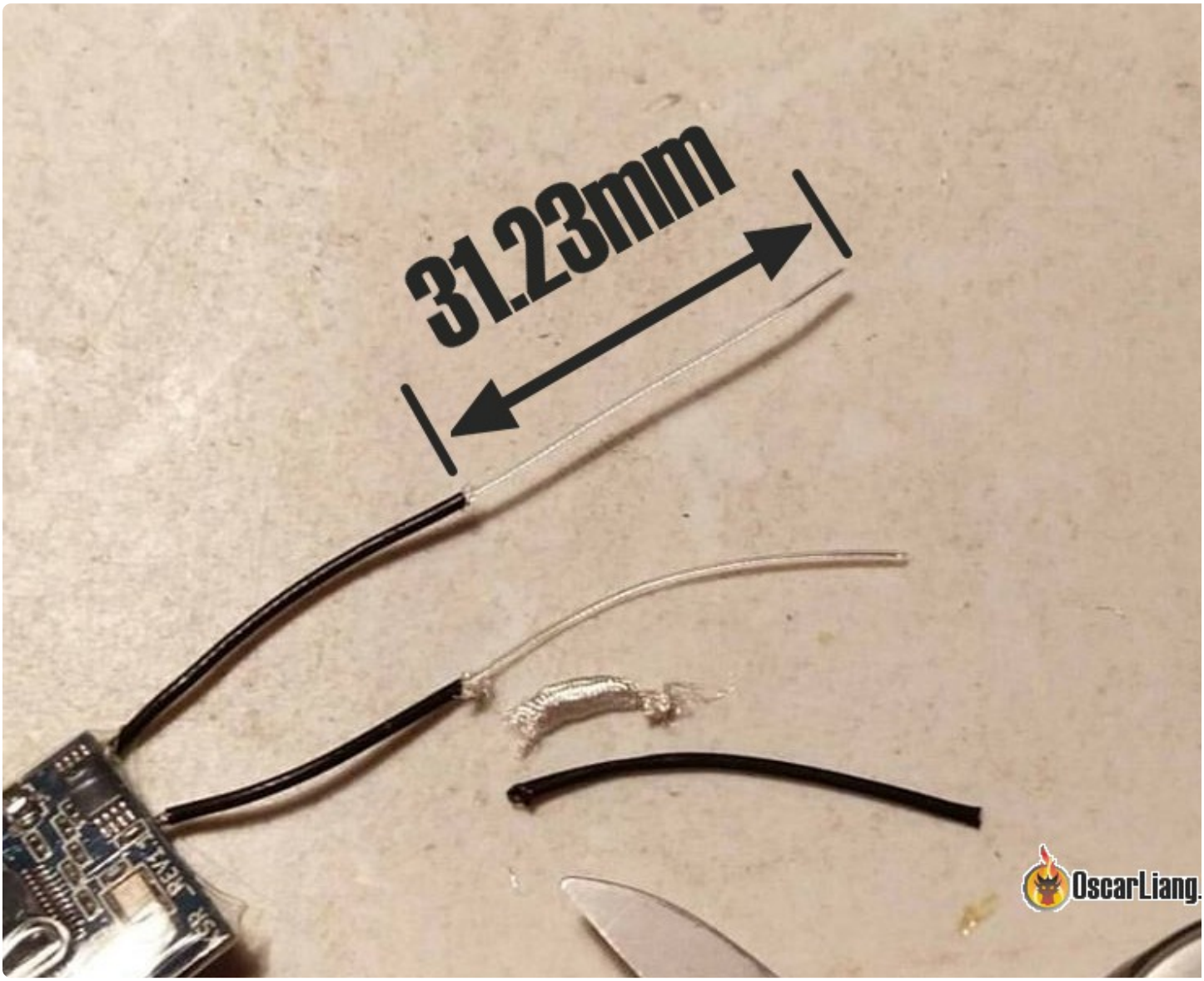


If you accidentally damage your 2.4GHz receiver antenna in a crash or by spinning propellers, don't w
You can easily fix it without buying a whole new receiver or replacement antenna. And there are considerations about the length of the antenna you should know about.

Further Reading: Learn about the basics of radio transmitter and receivers.

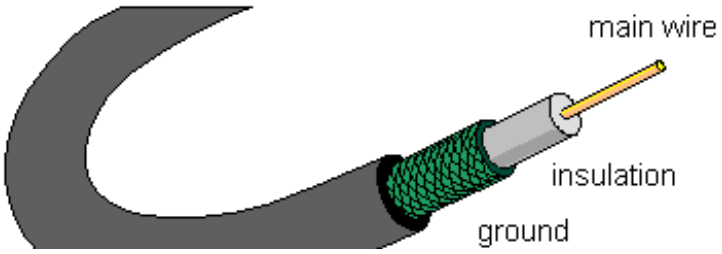
on of Receiver Antenna

made from a coaxial cable (coax).

coaxial cable is plastic skin for physical protection. Th

oise getting in and signal getting out.

By removing the shielding reveals a thin insulated wire, which is the active element of your receiver an



The construction of a coaxial cable

The length of the active element of a monopole antenna is determined by the wavelength of the radio
The resonant frequency happens to be a quarter of the signal wavelength, where the inductance and capacitance in the antenna are equal and cancel each other out. At this point the received signal of thi frequency is the strongest.

With a shorter antenna we will have more capacitance. Or a longer antenna we will have more inducta The additional capacitive or inductive reactance will result in antenna performance degrade.

For 2.4GHz, the quarter wavelength antenna is about **31.23mm** long. (Enter this in google "**c / 2.4ghz**

Cutting Antenna and Stripping Shielding

The process of making or repairing 2.4Ghz receiver antenna is similar to what I described in our DIY 5 monopole antenna tutorial.

enna

ully cut and remove the surface plastic layer and the sed

na wire is, as long as there is only 31.23mm wire witho be a tiny bit longer or shorter, your antenna will still wo

with Longer or Shorter Antenr

why do some receivers have different antenna length?

example we measured the antennas on a few different Frsky RX's to be:

- R-XSR – 23.5mm
- X4R-SB – 33.25mm
- XSR – 26mm
- XM+ – 23mm

As mentioned, antenna that is too long or too short will change the capacitance and inductance in the and shifts the resonant frequency. But in fact, we can **adjust the capacitance and inductance by ad inductor or capacitor** at the root, so theoretically we can tune the antenna to any length we want!

This might be why some receivers come with longer or shorter antennas than 31mm.

Therefore, my recommendation is, **follow the length of the original antenna that comes with the re** because receivers are not always optimized for the 1/4 wavelength! Only experiment with different ant length if you are getting really bad range.

Heatshrink / Tubes Changes Antenna Frequency?

Putting antennas in heatshrink or plastic tube for protection will “de-tune” its frequency slightly. It might your signal strength very slightly, but it might not be enough to cause noticeable issues. We generally of.

ht

element (the exposed wire) is kept straight. Any bendi

lded Wire Matter?

of the shielded part of the antenna might also affect the miliar with the concept but I am told that by keeping th r wavelength, you should get better antenna performa

When fixing your RX antenna, you normally have to shorten the shielded wire to an odd length which c mess with the 1/4 wave antenna tuning and introduce unexpected problems. It’s interesting to note tha XSR receiver has 3/4 wavelength shielded wire, but it’s not the case on other Frsky receivers. Maybe i something to do with antenna tuning we just mentioned?

gth of the shielded antenna doesn't seem to affect rang
uads I even had the shielded wire shortened down to le
eems to work pretty well within 800m (not getting sign
range hard enough to notice the difference on a mini c

If you want to play safe, I think it's best to follow the length of the original antenna by modifying a brand replacement antenna.

Replacement RX Antennas

I always try to fix any broken RX antennas first, but if I started to get signal issues such as failsafe or li range, I just simply replace that antenna and save the headaches.

ney've started using a smaller version of the IPEX conı

ful when shopping for replacement antennas for your

nna

Edit History

- Feb 2015 – Article created
- Jan 2018 – Updated article with sections talking about “why some receivers have longer or shorte antennas than 1/4 wavelength”, and “does the length of the shielded wire matter?”.
- Mar 2018 – Added warning about the new IPEX connector for the latest Frsky receivers

previous post
SPI_RX – A New Receiver Protocol | FC with Built-in RX

r
Flight Controller USB Connection: CP

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n before appearing.

SUBMIT

62 COMMENTS

Well, an old page but I just did this to fix my banged up Moblite7 antenna and it worked a tr least in benchtop tests, will have to wait for the wind to die down to test at range.) Thanks f and all your other great pages.

Regarding the “exact length” debate I figure between the curve in the wire and the blurry ha edge of the sheath the idea of getting the length accurate to 2dp is pretty fanciful anyway.

Cheers and keep up the good work.

4th November 2021 - 5:21 am

Hello Oscar, if the exposed antenna is longer than 31.23mm this to will diminish reception? told yes by someone else buy wanted confirmation. Tyia!

DERIK

29th August 2021 - 8:10 pm

Hi can you joint a cut of wire ?

OSCAR

30th August 2021 - 5:56 pm

If it's just a piece of wire, yes. But if it's a shielded wire, then no.

ement over an antenna element, microwave it (with a s
aterial remains cool.

hs / quantity

I have an multiplex RX-5 with a single aerial (that is on a futaba 60cm extension) which wo great!

Now I want to swap to an FrSky RX6R (because I want to use opentx based transmitter)

Can I just connect, the extension onto one of the aerial terminals and leave the other blank

extension is the only way to get the aerial outside of the carbon hull?

Thanks again for your infosite!

19th August 2019 - 4:44 pm

I have a mini remote controller and there is a cable antenna soldered (only main wire and insulator) on it and no MMCX port; is it possible to connect a MMCX antenna directly on the without port ? How ? Can I solder only the main wire of MMCX antenna to my card and let ground without connexion ? Thanks if you can help because I really did not find any informa about it.

SLAVA CHROME

22nd July 2019 - 8:22 pm

Always used to put my antennas in double layer of heatshrink, after with ziptie third layer. And now I have read that it can reduce range :(((

here is a lot of bad info in this page. 31.23mm is simpl
cannot cut or extend your RX antenna without an ant
what a given antenna is tuned at! The 31.25mm anten
several incorrect assumptions. The first is that your rad
of frequencies between 2.4 and 2.5 GHz, so most ar
different length. The second is that that 31.25mm ant
requency IN A VACUUM AT THE SPEED OF LIGHT. T
wave slows down quite a lot in a wire, and even more in coax, and insulation slows it down does capacitance. This is a very complex topic with a lot of variables which is why if you ac measure antennas for receivers you'll find they're all different lengths as y ou noted! This is because of differencex in antenna material! A good intro to this topic: youtube.com/watch?v=8iBoRNyrrPM

OSCAR

it's a complicated subject, exactly.

most people in this hobby come from non-academic background and it's unlikely th would have a way to measure antennas.

as explained in this post, there are many factors that affects the length of the anter 31.2mm is just a general figure, or safe figure to try for 2.4GHz, if one doesn't have idea what antenna length it should be.

EFX

7th August 2021 - 10:15 am

Consider shortening the antenna by ~ the factor 0,94 and using the center frequency 2450MHz.

opic, but using 0,94 times is better. Without doing it, y 0MHz.

B back to life from drydock of 20 years on the shelf. M so I bought a new 2.4 GHz radio; not good for SUB,s! p the periscope and keep the top of the scope from go ntenna wire is too short. Can I lengthen it some how ?

18th March 2019 - 6:09 pm

Hi!

As prop cut my FS-A8S antenna, I used replacement antennas but made a range test.

First I cut the replacement antenna element to about 26mm the original FS-A8S length, my triggered at 200meters range.

Then I put replacement 2.4Ghz antenna pigtail on it without cutting, about 33mm le (nc

So my test resulted that we should use the full 2.4ghz sized antennas for better range, and cut them back.

At least with my FS-A8S this worked like this….

I also repeated the test again and got the same result.

PETE BARKER

2nd December 2018 - 6:07 pm

Hi, I have just swapped over from RC aircraft to yachts using my FrySky 2.4 rx that has 2 a
Do I have to mount the rx in a plastic hull with the aerials protruding parallel up & out of the
which will mean a water ingress problem. Thanks.

h hour ago. I flew at the same place as my previous XS
out 300-330m) and got a failsafe. Then I flew again no
ilsafe!? Do you ever heard of R-XSR failsafe problem
est FCC171009, SBUS, S.port if I don't missremembe

Check antennas are connected firmly? And they are not damaged?

DALE STEPHENSON

16th May 2018 - 2:20 pm

Hi Oscar,

I understand that the antenna should not be run along the carbon frame. What would be th

Thanks

Dale

OSCAR

17th May 2018 - 5:24 pm

The best position would be sticking out above the top plate like a letter “V”.

I often mount them on the arms too if I don’t have space, like this.

For short range flying that’s totally fine.

TOBY BURNETT

8th May 2018 - 4:17 pm

t help someone.

a with an ipex 3mm connector like I noticed mine had

uad last night. Just now I had an idea “ta dahh momer

ors before”

ou could get one at your local tip/ dump) and inside as

e ipex connectors with a good 10+ cm of coax going to

nest away from the WiFi module and you’ve got two ne

tructions.

eries that all hold charge well and will make a simple fp

goggle pack .

Greeting from up north (nr Oban)

OSCAR

9th May 2018 - 1:41 pm

good tip for emergency replacement :D but still easier to get a bunch of sp ol :D

3rd May 2018 - 4:37 pm

Can anyone tell me both covered and uncovers length of Fly sky R6B antenna length? I ne
length kept my manufacturer. So it will be tuned properly. please tell me if anyone having o

THOMASTHEDANKENGINE

8th March 2018 - 12:42 am

Mine came off at the solder joint. Any idea how i could fix that?

CELIA CAVASOTTO

20th February 2018 - 1:10 am

hi, i own a small drone with a 2.4 ghz wifi camera. about midway through the flight the
e signal weren´t strong enough. i opened the drone an
tenna (it was longer but did not reach the 1/2 wavelen
ssion range shorter when the battery is lower than norr

an be tuned by adjusting the reactance in the circuit, s
ver has to use antennas of the same length. Just stick
anufacturer you should be fine.

MARK

1st February 2018 - 11:49 pm

By “exposed”, I’m assuming that you can cover the 31.23 mm in plastic antenna shielding, stirrer, etc.? it doesn’t have to be open to air does it?

5th February 2018 - 2:38 pm

Yes, your can cover it with anything that is not RF shielding. Plastic should be fine.

STEVE

26th October 2017 - 10:38 pm

Your calculation is based on a wavelength in free space and does not take into consideratio velocity factor for the coax you are using for the whip antenna. Therefor the length of the ac part of the antenna will be between 69% to 95% of this length.

STOGFLY

30th August 2017 - 5:44 pm

the desired length part etc but at the solder point of th on the fc/pcb board, that part is also exposed at aroun ded somehow?

le rounded the value to 300 000 000 instead of 299 79

4 = 11.29

With 300 000 000/2.4ghz/4 = 33.25

This is practically double. What do you think

Thanks

Your website is great

Neogen974

11th August 2017 - 3:57 pm

speed of flight slows down a bit in air.

But I think that's close enough anyway :)

JOELSON JOSÉ DOS SANTOS

9th May 2018 - 2:44 pm

Esta conta está super errada.

R= 31.22 mm

JOYVEL

4th August 2017 - 11:23 am

I was flying a FlySky that comes with a different anten
e and I broke one, can I attach any other antenna fron
antenna from a X8R receiver? Thank You

1st August 2017 - 9:20 pm

What about those of us that have the boda antenna ? Can you cut those out all together or you re solder anything to them?

IFLYHIGH

27th October 2018 - 12:22 am

nterchangeable since they all operate at 2.4Ghz. just r
e antenna are the same.

metal piece under the heat shrink. Cut the antenna as you would with a straight wi
then solder the shielding to metal sleeve and expose the center wire out of the top
lost the sleeve, no worries because the antenna will still work, but the concept of th
sleeve is to reduce interference. That being said, you can make a BODA antenna
receiver if you have the proper length sleeve.

BLACK

25th July 2017 - 11:06 am

Hi,

I see that the XM+ antennas do not come at the length you calculate. They come at 21 mm
you have any opinion about this?

K such as the XSR, antennas come at different length
wavelength..
in to have range issue with that and they strip the shie
.e. 31mm.
uld try this.

14th March 2017 - 10:16 pm

Hi Oscar,

I am currently in the process of waterproofing my multirotor.. it is hard to do that with my St
Futaba Rxs coaxial antennae. My thought is to use a SMA to U.FL wall panel adapter mou
using a more traditional plastic 2.4 antenna instead. Is there any reason I can't do this or a
need to take into consideration?

HAMIDREZA

24th December 2016 - 11:05 am

Hi dear,

Last week i had rc airplane crash.

Till know i cut around 6cm of the reciever antenna because of crash.

The people there said that i crashed because the lenth of the main wire anttena is not long enough. But i should mention that always i had 3 cm unshield anttena our of the rc airplan than the shieldet part.

The question is that the lenght of the antenna wire is important or just it is important that th 3cm unshield of antenna wire?.

shield part of the antenna matters, but I guess if the a signal gets blocked by aircraft material.

enna needs to be connectet to a ground? If so:

I just received an Devo-RX601 receiver for my devo 7 controller to use in a Quad, and noti the antennas are really short. I need them to be longer. I have several antennas that is ma Rc 2.4GHz receivers, so I know that they are correct for the purpose. However, the antenn followed the receiver are so short, they are not shielded (or coaxed?). Therefore the receiv no ground solder point for the shielding. Would it work if I connected it to another ground th somewhat connected to my battery? Let's say the ground connecting to the receive

OSCAR

22nd November 2016 - 1:27 pm

Hi, yes the shielding needs to be connected to ground.

Yes ground should be common on the receiver PCB, so any ground should do.

KWAD

3rd December 2016 - 10:57 pm

Thanks!

Only tested it indoors so far, but seemed to work great! This site is awesor

Thumbs up!

50 advanced with gps. Not had much luck with the gps flying fine even after a few crashes and rebuilds. But noticed on my earlier model both ariel wires wasn't stripped down at all. They had the full o plastic casing all the way to the top but I was still flying using both my devo 7 and devo 12E over half a mile with no issues. The other day I completely cut one of the wires off after a cr the way down to the receiver unit so there was only 1 wire left. It still flew out over 1/4 of a r before ran out of batteries. Anyway I have bought some replacement 2.7 wire to repair it ar correct that I can completely remove the wire from the circuit board and just re solder my n

so will only have 1 connection to the board instead of 2.

OSCAR

6th April 2016 - 3:43 pm

maybe the top end of the plastic casing has no shielding?

FIVEDRAGON

8th March 2016 - 2:39 am

So I just get crashed and my exposed antenna wire is gone. So if I make that 31.23 mm sh on that broken antenna, its gonna make the total length of wire shorter on one side. Is that

ave an antenna question. Some back ground I am build 2.4 receiver inside the vessel's hull for waterproofing. enna so it is well out of the water. Can you explain how could be done. Also what are the implications of occasional spray contacting the exposed antenna?

RAFAL

19th January 2016 - 9:18 pm

Hi Oscar … thank you for your blog.

casing off course :) as an RX antenna?

I have one of those and I'm asking because from the tip of the weird bullet dome to the tip o actual antenna core it's measuring 2.55cm not 3.123cm like you said.

REVOMIKEY

7th December 2015 - 6:36 pm

Tell you what though Oscar, i have a thought….. (Dangerous :))

When the cable gets too short to facilitate 32mm whats to stop me unsoldering the coax completely and just adding a normal piece of single core antenna cable to the center core j the pcb and just trimming that back to 32mm, eliminating the outer core completely.

Would this work?

ng it :)

tenna was just the "open" side, I now have my walker

Top man, many thanks.

JAKE

16th November 2015 - 12:01 am

Thanks for all your posts and pages! Very helpful overall… So I cut my antenna the other d

amount exposed? My question is can I solder on a wire and then expose the very end of it match the preferred length? I had a longer antenna and would like to replace it to the same if possible. Thanks!

OSCAR

16th November 2015 - 10:02 am

i think so Jake that should work, after you done that just do a range test and make that's working reliably i guess

TRAVIS

3rd March 2016 - 11:32 pm

antenna wire with the shield contacting the receiver's
a shield to ground.

antenna is only the exposed wire ? Does it mean tha
er the frame and really just care to properly place thos

12th August 2015 - 5:02 pm

That's correct! yes you can!

CHARLES

27th March 2015 - 3:06 pm

Hi,

in the RC community. My question is,

can I tin the expose wire? What will happen if its tinned?

Thank you

OSCAR

29th March 2015 - 11:03 am

sorry why do you want to tin it? I don't think it would do anything really…

JIRI

27th February 2015 - 6:18 pm

Hi Oscar

entence. Longer antenna means lower resonant frequ

a will be OK within 1 to 2 mm tolerance.

ated now :)

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